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Specification

PROJECT FILE NO. 021052

Backhoe Modifications – Boom Cylinder Modification for the OU 7-10 Glovebox Excavator Method Project

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

Idaho National Engineering and Environmental Laboratory

Form 412.14
07/24/2001
Rev. 03

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FIGURES

ACRONYMS

ANSI	American National Standards Institute
ASNT	American Society of Nondestructive Testing
ASTM	American Society of Testing and Materials
AWS	American Welding Society
BBWI	Bechtel BWXT Idaho, LLC
CFR	Code of Federal Regulations
INEEL	Idaho National Engineering and Environmental Laboratory
RCS	Retrieval Confinement Structure
SAE	Society of Automotive Engineers

1. SUMMARY

1.1 General

The Idaho National Engineering and Environmental Laboratory (INEEL), a Department of Energy national laboratory operated by Bechtel BWXT Idaho, LLC (BBWI), will procure a backhoe excavation system. The backhoe excavation system incorporates a modified CAT 446B backhoe loader and associated end effectors. The backhoe loader will be the primary instrument used in the retrieval of radioactively contaminated waste in the Operable Unit 7-10 Glovebox Excavator Method Project.

This project incorporates a Retrieval Confinement Structure (RCS) located over an excavation site. The RCS consists of a steel-framed, steel-paneled structure with Lexan windows. The RCS is located within a larger fabric-skinned Weather Enclosure Structure. Packaging Glovebox Systems are attached directly to the RCS and are fed by track-guided transfer carts.

A standard CAT 446B backhoe performs soil excavation, probe removal, 55-gal drum removal, and core sampling. The backhoe cab and loader are located outside the RCS, while the boom, stick, and various end effectors are located inside the contaminated RCS structure.

A flat outer boot separates the backhoe operator from the RCS (see Figure 1). This outer boot is located between the operator cab and the boom pivot point. The backhoe boom is designed to crowd against the operator window during transport. Because of this design feature, the operator window, located directly over the backhoe boot, can be penetrated by the boom cylinder support (see Figure 2).

To prevent the boom from retracting to a collision point, the boom cylinder (cylinder that raises and lowers the boom) shall be modified with a longer cylinder rod. The longer cylinder rod prevents the boom from penetrating the operator window. In addition, the internal cylinder's snubber system slows the progress of the boom near the window.

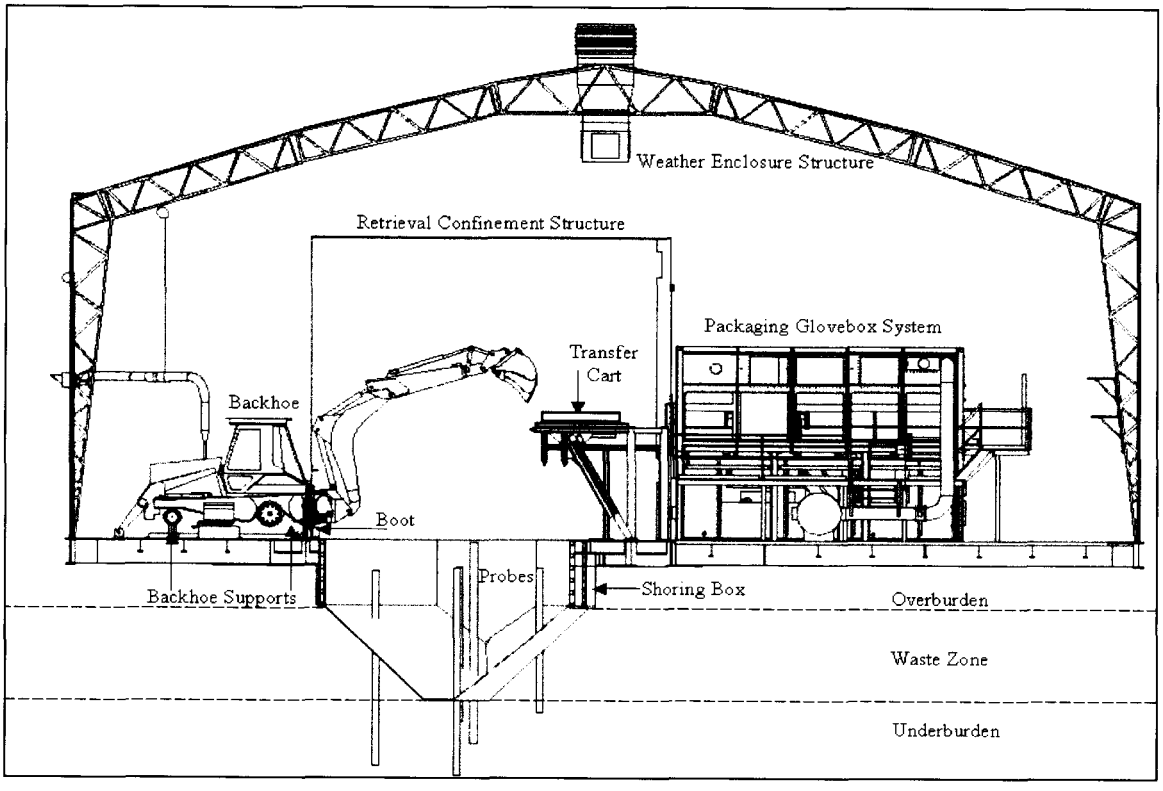

Figure 1. Cross section of the Glovebox Excavator Method Project facility.

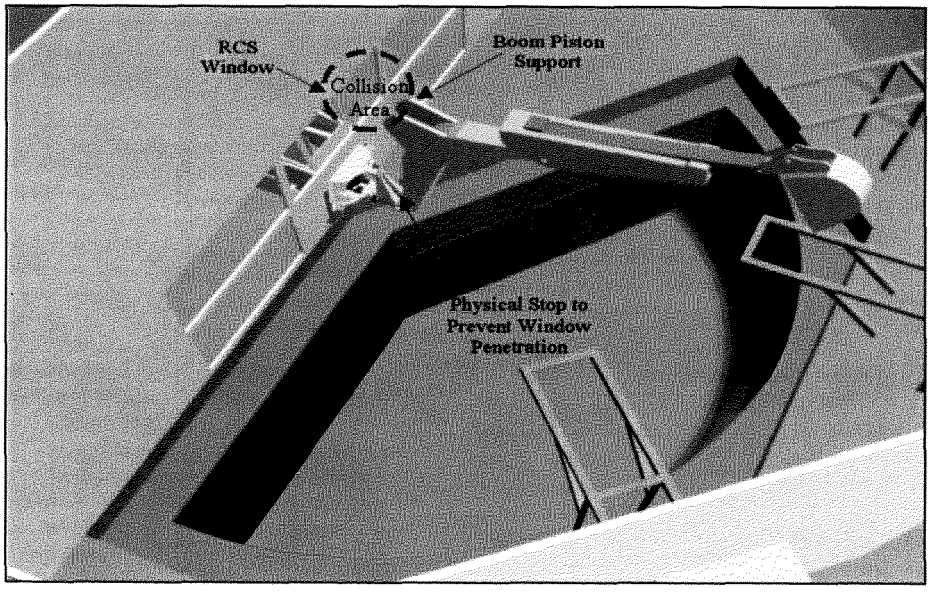

Figure 2. Retrieval Confinement Structure window penetration by boom cylinder support.

1.2 Work Included

This specification covers the subcontractor and equipment supplier's requirements for the design, fabrication, assembly, installation, and testing of the boom cylinder modification. It is not the intent of this specification to completely define all details of installation. Equipment shall be designed, fabricated, assembled, and installed in accordance with this specification and the equipment supplier's and subcontractor's standard practices when such practices do not conflict with this specification.

The lengthened cylinder rod, and all associated hardware, shall be completely assembled and installed into the CAT 446B backhoe at the subcontractor's facility.

The following shall be delivered to BBWI:

- A complete and fully integrated boom cylinder system on a 446B backhoe
- Vendor data submittals in accordance with the vendor data schedule and this specification.

1.3 Work Not Included

- Not Applicable

1.4 INEEL-Furnished Materials, Equipment, and Services

The INEEL will furnish the CAT 446B backhoe loader.

2. APPLICABLE CODES, PROCEDURES, AND REFERENCES

The following documents form a part of this specification to the extent specified herein and as applicable. Unless otherwise specified, the issue in effect on the date of invitation to bid shall apply. In case of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1 National and Local Codes

Occupational Safety and Health Administration

29 CFR 1910, Occupational Safety and Health Standards

2.2 Industry Standards and DOE Orders

American Institute of Steel Construction, Manual of Steel Construction

American Society of Testing and Materials (ASTM)

ASTM A36, Standard Specification for Carbon Structural Steel

ASTM A570, Standard Specification for Structural Steel, Sheet and Strip, Carbon, Hot-Rolled

ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength

American Society of Nondestructive Testing (ASNT)

ASNT SNT-TC-1A, Qualification and Certification of Nondestructive Personnel

Society of Automotive Engineers (SAE)

SAE J31, Hydraulic Backhoe Lift Capacity

SAE J1097, Hydraulic Excavator Lift Capacity Calculation and Test Procedure

SAE J1177, Hydraulic Excavator Operator Controls, Recommended Practices (This specification is provided for reference only. It is not a requirement.)

SAE J1179, Hydraulic Excavator Digging Forces, Recommended Practices (This specification is provided for reference only. It is not a requirement.)

SAE J1336, Hydraulic Cylinder Leakage Test (This specification is provided for reference only. It is not a requirement.)

American National Standards Institute (ANSI)/American Welding Society (AWS)

ANSI/AWS A2.4, Standard Symbols for Welding, Brazing, and Non-Destructive Examination

ANSI/AWS D1.1, Structural Welding Code Steel

ANSI/AWS D9.1, Welding Requirements for Sheet Metal

ANSI/AWS D14.1, Welding of Industrial and Mill Cranes and Other Material Handling Equipment

2.3 Military (National) Specification

Not applicable.

2.4 Related Specifications

Not applicable.

2.5 References

Not applicable.

3. TECHNICAL REQUIREMENTS

3.1 General

The equipment supplier or subcontractor shall design the installed/modified boom cylinder to provide for a fully functional system and to perform as specified in a safe and efficient manner. This section defines the design requirements for the modified boom cylinder.

3.1.1 Limitation on Boom Curl

A flat outer boot separates the backhoe operator from the RCS. This outer boot is located between the operator cab and the boom pivot point. The backhoe boom is designed to crowd against the operator window during transport. Because of this design feature, the operator window, located directly over the backhoe boot, can be penetrated by the standard boom cylinder support (see Figure 2).

To prevent the boom from retracting to a collision point, the boom cylinder rod (that raises and lowers the boom) shall be replaced with a longer cylinder rod. The longer cylinder rod shall prevent the boom from penetrating the operator window.

The new boom cylinder rod shall be designed to prevent any part of the boom from extending 6 in. past the swing frame pivot pin in the direction of the backhoe cab, as shown in Figure 3.

3.2 Restrictions

None identified.

3.3 Performance Requirements

The modified boom cylinder shall be capable of stopping any part of the boom extending 6 in. past the swing frame pivot pin in the direction of the backhoe cab, as shown in Figure 3.

3.4 Software

Not applicable.

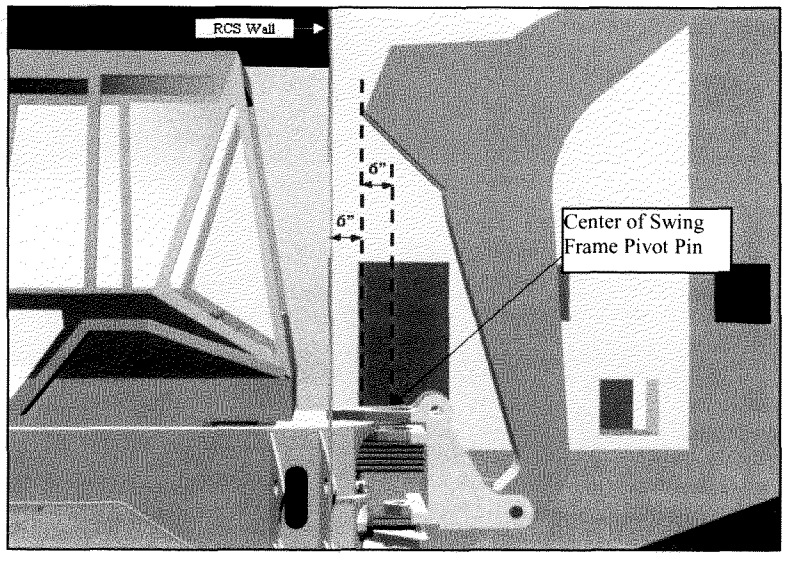

Figure 3. Limitation on boom curl.

3.5 Registered Professional Engineer Certification

Not applicable.

3.6 Human Factors

Not applicable.

3.7 Reliability and Maintainability

All subcomponents of the modified boom cylinder rod shall be of a quality that the expected mean time between failure for this system shall not be less than 1,080 hours.

3.8 Environmental Regulatory Requirements and/or Site and Operating Requirements

Not applicable.

3.9 Natural Phenomena Requirements

Not applicable.

4. ENVIRONMENTAL, SAFETY, AND HEALTH REQUIREMENTS

4.1 Subcontractor Safety

The subcontractor shall work in accordance with applicable Occupational Safety and Health Administration requirements, as stated in 29 CFR 1910, "Occupational Safety and Health Administration."

4.2 Personal Protective Equipment

The subcontractor shall determine and require use of appropriate personal protective equipment for all tasks performed.

4.3 Emergency Response

Not applicable.

4.4 Accident Investigation

Not applicable.

5. MANUFACTURING AND ASSEMBLY

5.1 General

The modified boom cylinder shall be installed onto a CAT 446B backhoe, in the subcontractor's shop, to ensure proper fit and operation. The contractor's technical representative or alternate will inspect the assembled final product. Assembly of the equipment shall be made in a clean, dust-free area of the subcontractor's facility.

A manufacturing inspection test plan shall be submitted to the contractor before release for fabrication. The plan shall detail the fabrication, assembly, installation, inspection, examination, and test process to be performed. The plan shall be submitted for approval prior to supplier initiation of any manufacturing, inspection, or test activities, for incorporation of contractor source inspection hold points.

5.2 Prohibitions

None identified.

5.3 Material

Materials used shall be free from defects that would adversely affect the performance or maintainability of individual components or the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in the equipment manufacturer's standard commercial practice.

5.4 Fabrication

5.4.1 Welding

Welding shall be performed in accordance with the subcontractor's drawings and as specified herein. All welding shall be performed in accordance with AWS D 1.1 for statically loaded nontubular structures or AWS D XX, as applicable. Welders and weld procedures shall be qualified in accordance with AWS D 1.1 for statically loaded nontubular structures or AWS D XX, as applicable. Weld procedures, welder qualifications, and nondestructive testing methods, shall be submitted to the contractor for approval before performing any welding. Wherever stress relieving is required to maintain dimensional requirements, it shall be done before machining. Finished weld surfaces shall be free of defects. Welds being ground must be kept cool at all times to minimize distortion and discoloration. The original material thickness shall be maintained after all grinding and polishing processes.

5.4.2 Finish and Fit

The fit and finish of the modified piston rod shall be identical or better than the piston rod it replaces.

All mill and fabrication markings must be removed (i.e., center punch marks, scribe lines, and stampings). All exposed surfaces shall be free of sharp edges, cracks, pits, oxides, embedded slag, burns, weld splatter, sharp ridges, grooves, tool marks, or any other surface irregularities. All parts shall be free of burrs and sharp edges. All components drilled or machined shall be deburred and cleaned after the work has been completed. All fits shall be made without using shims unless specified on the drawings and where fits can be made without stressing or forcing components or materials beyond where such force fits are specified.

5.5 Equipment Tagging

Not applicable.

5.6 Cleaning, Painting, and Coating

The modified boom cylinder shall be thoroughly cleaned. All scale, oxides, lubricants, chips, and other foreign matter shall be removed. All burrs, castings scars, and sharp edges shall be ground smooth.

5.7 Spare Parts

Not applicable.

5.8 Other Processes

Not applicable.

6. SUBMITTALS

As a minimum, the subcontractor shall provide the contractor with the submittals referenced in this section. The subcontractor shall be responsible for all submittals that come from the equipment supplier. Additional submittal requirements are defined in the vendor data schedule and applicable contract documents. The quantities and submittal schedule are included in the attached vendor data schedule.

6.1 General Submittal Requirements

6.1.1 General Procedures

Vendor data, whether prepared by the subcontractor or subcontractor's subtier or supplier, shall be submitted as instruments of the subcontractor. Therefore, prior to submittal, the subcontractor shall ascertain that material and equipment covered by the submittal and the contents of the submittal itself meet all the requirements of the subcontract specifications.

Each submittal shall contain identification for each separable and separate piece of material or equipment, and literature with respect to the information provided in the specification and on the vendor data schedule. Submittals shall be numbered consecutively for each different submittal.

6.1.2 Vendor Data Schedule

Vendor data required by the specification sections are identified on the vendor data schedule. The vendor data schedule provides a tabular listing by item number, specification reference, and description of the item or

service. The type of submittal is identified by a vendor data code, and the time required to submit the item is identified by a when to submit code. An approval code specifies whether the submittal is for Mandatory Approval or for information only. One copy of routine paper or electronic file submittals is required; the vendor data schedule may require additional copies. Electronic file submittals are preferred.

6.1.3 Vendor Data Transmittal and Disposition Form 431.13

All vendor data shall be submitted to the contractor using the Vendor Data Transmittal and Disposition Form. The form provides the subcontractor a method to submit vendor data and provides the contractor a means of dispositioning the submittal. The subcontractor shall list the vendor data schedule item number, a vendor data transmittal tracking number (if applicable), specification number reference, a tag number (if applicable), the submittal status (e.g., mandatory approval, information only, or resubmittal), the revision level, and the item description. The description should be complete enough that a person unfamiliar with the project can determine what is included in the submittal.

6.1.4 Disposition by the Contractor

The contractor's comments and required action by the subcontractor will be indicated by a disposition code on the submittal. The disposition codes will be classed as follows:

A. **Work May Proceed:** Submittals so noted will generally be classed as data that appear t be satisfactory without corrections.

B. **Work May Proceed with Comments Incorporated. Revise Affected Sections and Resubmit Entire Submittal:** This category will cover data that, with the correction of comments noted or marked on the submittal, appear to be satisfactory and require no further review by the contractor prior to construction.

C. **Work May NOT Proceed. Revise and Resubmit:** Submittals so dispositioned will require a corrected re-submittal for one of the following reasons:

(1) Submittal requires corrections, shown on comments, prior to final review.

(2) Submittal data are incomplete and require more detailed information prior to the final review.

(3) Submittal data do not meet subcontract document requirements.

D. **Accepted for Use. Information Only Submittal:** Submittals so dispositioned will generally be classified as information only for as-specified material and equipment.

Mandatory Approval-coded vendor data will be reviewed by the contractor and receive an A, B, or C disposition. Information only submittals without comments will receive a D disposition. The A, B, and C-coded dispositioned submittals will be returned to the subcontractor. The D-dispositioned submittals will not be returned to the subcontractor. The contractor may provide internal review of information only submittals. In the event that comments are generated on an information only submittal, the submittal may be dispositioned B or C and returned to the subcontractor for appropriate action. Acknowledgment of receipt of dispositioned vendor data by the subcontractor will not be required.

The contractor will return dispositioned submittals with reasonable promptness. The subcontractor shall note that a prompt review is dependent on timely and complete submittals in strict accordance with these instructions.

6.2 Spare Parts and Special Tools List

Not applicable.

6.3 Operations and Maintenance Manuals

Not applicable.

6.4 Drawings

The equipment supplier shall submit prints of the final drawings disclosing the configuration of the modified boom cylinder. These drawings shall document the mechanical configuration. The drawings shall be of sufficient detail to allow the contractor to identify and evaluate the systems and components for installation, operation, maintenance, and repair activities without detailed physical inspection of the actual hardware.

6.5 Software

Not applicable.

6.6 Weld History

6.6.1 Weld Procedures

Welding procedures shall be in accordance with AWS D 1.1 for statically loaded nontubular structures or AWS D XX, as applicable. A copy of the weld procedures to be used in this work shall be submitted to BBWI for approval prior to fabrication.

6.6.2 Welder Qualifications

All welder qualifications and qualification procedures shall be in accordance with AWS D 1.1 for statically loaded nontubular structures or AWS D XX, as applicable. Copies of welder qualifications shall be submitted to BBWI for approval prior to fabrication.

6.6.3 Nondestructive Examination Procedures and Qualifications

Liquid penetrant testing, radiographs, and inspections shall be performed in accordance with Section 7.5 of this specification. All nondestructive examination procedures and inspector qualifications shall be submitted to the INEEL for approval prior to fabrication.

6.6.4 Inspection Procedures

Procedures are required for dimensional, surface finish, cracks, and cleanliness inspections. All inspection procedures shall be submitted to the INEEL for approval prior to fabrication.

6.7 Inspection Test Plans, Procedures, and Reports

This includes the following:

Performance Test Procedures (Subcontractor Preshipment): Performance test plans, procedures, and reports as outlined in Section 7.4.1 of this specification.

Performance Test Reports (Subcontractor Preshipment): Performance test results and reports as outlined in Section 7.4.2 of this specification.

7. QUALITY ASSURANCE

7.1 Minimum Qualifications of Manufacturer, Supplier, or Personnel

The equipment shall be assembled, modified, and installed by a firm that has prior related experience pertaining to lengthening backhoe cylinder rods and installing backhoe cylinder rods within backhoe booms.

7.2 Quality Assurance Program

The manufacturer is responsible for providing materials and workmanship that meet the codes and standards identified in this specification.

7.3 Nondestructive Examination

7.3.1 Weld Inspections and Examinations

Visual examination will be performed for workmanship and all materials and components of the structure, as specified in this specification.

Visual examination of welding will be performed in accordance with AWS D 1.1 for cyclically loaded nontubular structures or AWS D XX, as applicable. Personnel performing visual examination of welds shall meet the requirements of AWS D 1.1.

7.4 Operational Testing

7.4.1 Performance Test Procedures (Subcontractor Preshipment)

The equipment supplier or subcontractor shall submit to the contractor an in-shop testing plan and procedure prior to demonstration of the modified boom cylinder's capabilities at stopping the boom at the predetermined location. Tests shall be performed at the equipment supplier or subcontractor's facility. The plan and procedure shall include the date, test conditions, duration of testing, testing sequence, materials used, and methods of performing the tests.

The subcontractor shall inform the contractor 1 week in advance of performance testing so a contractor representative may be present during the testing process.

Subcontractor testing should demonstrate that all equipment operates and interfaces together into a functional boom system, as defined within this specification.

Testing acceptance criteria:

- Confirm that fully retracted boom will not penetrate the RCS window.

7.4.2 Performance Test Report (Subcontractor Preshipment)

The equipment supplier or subcontractor shall submit to the contractor the "in-shop" testing results following the demonstration of the modified boom cylinder capabilities at stopping the boom at the predetermined location.

7.5 Special Processes

Not applicable.

8. PACKAGING AND SHIPPING

8.1 Packing and Packaging

Not applicable.

8.2 Marking and Handling

Not applicable.

8.3 Special Transportation Requirements

Not applicable.

9. INSTALLATION AND MAINTENANCE

9.1 Installation

The modified boom cylinder shall be installed into the CAT 446B backhoe, used for the Operable Unit 7-10 Glovebox Excavator Method Project, at the subcontractor's facility.

9.2 Startup and Calibration

Not applicable.

9.3 Training

Not applicable.

9.4 Maintenance

Not applicable.

10. MARKING AND IDENTIFICATION

Not applicable.

11. ACCEPTANCE

11.1 Final Acceptance Method

Successful performance of the test results and submittal of all documents listed on the vendor data schedule will constitute acceptance.

11.2 Inspection and Hold Points

The contractor shall determine inspection and hold points after review of the manufacturing/inspection/test plan.

Unless otherwise specified by the Purchase Order, the supplier shall notify the contractor at least 5 working days in advance of the time that the boom cylinder will be available for source inspection by the contractor representative. Work cannot proceed without written authorization from the contractor after hold point inspection.

11.3 INEEL Surveillance and Audits

The authorized contractor representative may perform source inspection or surveillance.

12. ATTACHMENTS

Vendor Data Schedule - Form 431.14

ATTACHMENT A

431.14
08/01/2001
Rev. 03

Vendor Data Schedule

Project Title OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT - BACKHOE MODIFICATION - BOOM CYLINDER MODIFICATION

Project No. 021052 - 21968

System Engineer/ Project Manager LOPEZ DARYL A **Date:** 12-APR-02 **Rev:** 0

Vendor Data Coordinator Address STURM BETH L, WCB-3WH502, MS: 3535

Vendor Data Codes				
A. As-Built Drawings B. Assembly Drawings C. Attendance Record D. Blasting Plan E. Catalog Data F. Chem & Physical Analysis G. Concrete Mix Design H. Control System Diagram I. Design Calculations J. Installation Instructions	K. Manufacturers Data Report L. O&M Manual M. Parts List N. Piping Drawing O. Procedure/Instructions P. Pump Head Curves Q. Personnel Qualifications R. Red_line Drawings S. RSMI & Maintenance Log T. Sample(Color, Texture, etc.)	U. Shop Drawings V. Survey Records W. Test Procedure X. Special Processes Y. Operational/CC Testing Z. Test Reports AA. UL/FM Listing AB. Warranty/Guarantee AC. Weld Records AD. Wiring Diagrams	AE. MSDS AF. Hardware Schedule AG. Specification AH. Manufacturing/Inspection/Test Plan AI. Test Certification AJ. Recommended Spares AK. Special Tools List AL. Certificate of Conformance AM. Certificate of Disposal or Destruction AN. Design Verification	AO. Design Qualification Testing AP. Traceability Procedure AQ. Cleaning Procedure AR. Weld Procedure Qualification AS. Welder Performance Personnel Qualifications AT. Non-Destructive Examination Personnel Certifications AU. Inspector Certifications AV. Limited Shelf Life/Operational Data AW. Special Packaging, Shipping, and Rigging Procedure AX. Certificate of Materials to ASME Code AY. Chemical Inventory AZ. Other
When to Submit				
AC - As Completed AT - After Test BC - Before Contract Awarded	BFA - Before Final Acceptance BFR - Before Fabrication Release ROS - Removed Off-Site PDS - Prior to Delivery on site	PTP - Prior to Purchase PS - Prior to Shipment PT - Prior to Test	PTC - Prior to Construction Start PTI - Prior to Installation PTW - Prior to Welding	TS - Time of Shipment WP - With Proposal

Specification Environmental Restoration	**BACKHOE MODIFICATIONS – BOOM CYLINDER MODIFICATION FOR THE OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT**	Identifier: SPC-401 Revision: 0 Page: **A2** of A2

ATTACHMENT A

Item No.	Clause/Article or Drawing/Specification Reference	Description	Vendor Data Code	Extra Copies Required	When to Submit	Approval Code
	7.4.1		W. Test Procedure	4	PT - Prior to Test	Approval Required
	7.4.2		Z. Test Reports	4	AT - After Test	Approval Required
	6.4		A. As-Built Drawings	4	BFR - Before Fabrication Release	Approval Required
	6.6.1		AR. Weld Procedure Qualification	4	BFR - Before Fabrication Release	Approval Required
	6.6.2		AS. Welder Performance Personnel Qualifications	4	BFR - Before Fabrication Release	Approval Required
	6.6.3		AT. Non-Destructive Examination Personnel Certifications	4	BFR - Before Fabrication Release	Approval Required
	6.6.4	Inspection Procedures	AZ. Other	4	BFR - Before Fabrication Release	Approval Required
	5.1		AH. Manufacturing/Inspection/Test Plan	4	BFR - Before Fabrication Release	Approval Required

Instructions:
1. Refer to subcontract documents for instructions on submittals.
2. Electronic submittals in lieu of paper documents are acceptable and encouraged.
3. The normal number of copies required is ONE. If more are required, the number will be shown here.
4. THE INEEL WILL SCAN ALL SUBMITTED VENDOR DATA INTO A SYSTEM THAT IS ACCESSIBLE TO ALL INEEL EMPLOYEES UNLESS THE SUPPLIER/SUBCONTRACTOR IDENTIFIES SUBMITTED INFORMATION AS PROPRIETARY.